Sound Waves

Procedures: Go to http://www.colorado.edu/physics/phet and find the "Sound" simulation.

Listen to a Single Source:

1. Observe the sound waves coming from the speaker.

   a) What do the dark and light bands represent? (Remember, sound waves are *longitudinal* waves.)

   b) Why do the waves get lighter with distance from the speaker?

   c) How does changing the frequency and amplitude affect the depiction of the sound waves in the simulation?

   d) How do you think changing the frequency and amplitude affect the sound **heard** by the listener?

Measure:

2. Press "start" and move the ruler to the center of the speaker.

   a) Look at the stopwatch. What do you notice that is strange about it? Why is it programmed this way?

   b) Describe how you would find the frequency of a wave if the frequency slider did not have a number display. Test your idea with a variety of waves (record them in a data table) and describe how well your procedure gives results that match the frequency display.

c) Describe how you would find the period of a wave without using the frequency information. Test your idea with a variety of waves and record your experiment in a data table. Check your method by calculating the period using the frequency ($T = 1/f$). Show calculations.

d) Hit stop and reset, and measure the distance a wave travels in a certain amount of time. Make a data table and do at least 3 trials. Find the speed of sound using $v = d/t$.

e) Use the ruler to measure the wavelength of this sound wave. Check the speed calculated above using $v = f\lambda$.

Two-Source Interference:

3. Observe the interference pattern made by the sound waves coming from two speakers.
   a) Sketch the pattern using shades of gray.

   b) Describe what is happening with the waves where you see white spots, dark spots, and gray spots.

   Draw some pictures of waves to help your explanation.

Sound Lab using LabPro

Get a LabPro and microphone, and then connect to a computer. **Setup the Sensor** through the **Experiment** tab if necessary.

1. Say "AAAAAAAA" smoothly into the microphone and hit **Collect**. Once you get a graph that you think is quality, copy it to a Word document and label it #1. Answer the following questions in your document.

a) Would you say this is a periodic wave? Support your answer with characteristics.

b) How many waves are shown in this sample? Explain how you determined this number.

c) Relate how long the probe collected data to something in your everyday experience. For example: "Lunch passes by at a snails pace." Or "Physics class flies by as fast as a jet by the window."

d) What is the period of these waves? Explain how you determined the period.

e) What is the frequency of these waves? Explain how you determined the frequency.

f) Calculate the wavelength assuming the speed of sound to be 340 m/s. Relate the length of the sound wave to something in the class room.

g) What is the amplitude of these waves? Explain how you determined amplitude.

h) What would be different about the graph if the sample were 10 times as long? How would your answers for the questions a-g change? Explain your thinking. Change the sample rate and test your ideas. Copy the graph and label it #1h.

2. Now have someone else in your group say "AAAAAA" into the microphone. Copy the graph and label it #2. Compare and contrast the two people's wave patterns. Be specific in your answer. For example: determine the characteristics that you did for the first person (# of waves, frequency, period, amplitude, and wavelength) and include any qualitative observations.

3. Collect data for a tuning fork by striking it on a soft object. Copy the graph and label it #3. Compare and contrast the waves made by human voice.

4. If you use the same tuning fork to collect data for a sound that is not as loud, what changes would you expect on the display from the sample in #3? Test your ideas. Copy the graph and label it #4. What did you do to make the sound softer? Compare and contrast the waves collected for the louder sound.